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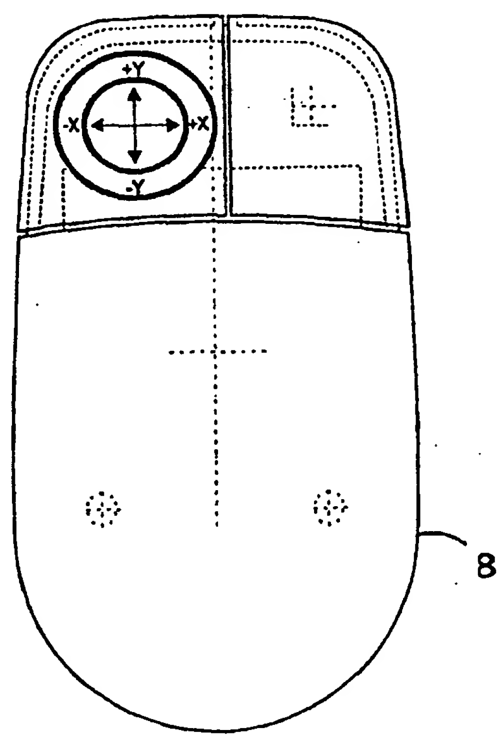
(57) Abstract

System for controlling a marker (5) on a data screen or similar using a pointer tool (8) as a per se known type, the pointer tool comprising an indication device (1, 2, 110, 111, 112) for tactile feedback to the user for transferring information about the markers movements on the screen, the indication device (1, 2, 110, 111, 112) for tactile feedback adapted to transmit information in at least two dimensions.



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METHOD AND SYSTEM FOR IMPROVED COMMUNICATION BETWEEN HUMAN AND COMPUTER

This invention relates to a system controlling a marker (5) on e.g. a computer screen using a pointer tool (8) of a per se known type, the pointer tool comprising an indication device (1,2,110,111,112) for tactile feedback to the user for transferring information about the markers movements on the screen.

Electronic computers have in recent years become the most important tool for many working in the fields of production of documents, graphic design, technical drawings etc, as well as in number treatment such as large calculations, statistics, administrative systems, quality control systems, accounting etc. Many of the tasks which at the present are usual in small companies and with private persons, was unthinkable a relative short time ago even for larger and more resourceful companies.

The development of the computer with necessary peripheral equipment (display, keyboard, pointer tools, printers and other terminal devices) has made it possible to utilize increasingly powerful software in an increasing number of sectors. New and more powerful software is developed to use the improved computers - and vica versa - as a continuous process. The development has repeatedly provided shorter operation time for each working operation and more storing capacity, both for intermediate calculations and for the final results. This has made it possible to establish large program libraries, procedure archives and databases for storing of knowledge and experience and to retrieve them in an effective way.

The possibilities for the operator to fast and efficiently communicate with the computer has, however, mainly been limited by the computers ability to present the results of the completed work on a screen as text or a graphic image, or possibly as a paper print. The operator then has to read or in other ways interpret te results visually before ant corrections may be planned and performed - and the work possibly may continue.

The most common types of equipment used to give control

commands as well as provide necessary information to the computer for performing the work is:

* Pointer tools (such as "mouse", "Joystick", "Roller ball", or pressure sensitive pads);
* Keyboard (as for a typewriter)

The operator gives commands necessary to perform the task using the pointer tool or keyboard. From a computer screen or print he may thus obtain a receipt confirming that the task was performed.

The use of the pointer tool requires that a graphical interface is established in the communication from the computer to the operator. By far the most computers today use such an interface and an operative system being based on extended use of a pointer tool (e.g. Windows 95). For sake of simplicity the description of the pointer tool will here be limited to use of the pointer tool of the mouse type. It is, however, clear that the invention may also be used n relation to other pointer tools.

Using the pointer tool the movements of a marker, often being a symbol shaped as an arrow head, may be controlled within the image shown on the computer screen. In combination with or with the aid of switches on the pointer tool an object may be marked as singular points as well as larger or smaller areas in the shown image, in which it is desired to make changes or one in some way will provide information to the computer.

On a computer screen a "point" is, however, in reality always an area, i.e. the "point" will have a certain extension on the display. In the following part of this description a point means: the smallest area which may be pointed at with the marker. Several "points" constitutes an "area". The monitoring confirming that the marker is controlled correctly and accurately is performed by following the movements with the eyes. If the possible areas which may be selected is positioned close to each other, a high degree of accuracy and attentiveness in the navigation of the marker is demanded if errors are to be avoided.

The use of a pointer tool such as a mouse or similar has thus become a limitation in the exploitation of the

capacity of modern computers. Most likely the intens concentration being demanded from the operator when performing the detailed steering in high precision navigation, makes the operator tired and unattentive. The precision is reduced, errors occur and the real capacity exploitation in the operator/computer combination is reduced.

Feedback to the operator through the mouse has been suggested when the marker passes over an object on the computer screen. Examples of such solutions are shown in EP 607,580 and EP 265,011. This information given to the operator is, however, insufficient, as he still will have to watch the screen to control the marker to the right position.

Thus it is an object of this invention to provide a system which solves these problems, and thus increases the efficiency of both the computer and the user. This object is obtained using a system as described above, and characterized as given in claim 1.

The present invention functions as a tactile, interactive system.

- It provides direct feedback to the hand, in parallel and simultaneously as the same changes are shown on the screen, i.e. the operator may se and feel the information from the computer simultaneously.
- The operator may thus choose between or combine the two forms of sensed impressions when receiving information from the computer, and hand and pointer tool may thus feel their way.
- The hand and the felt change in the mouse may thus take over some of the routine work in steering the pointer tool and thus liberate brain capacity for more demanding tasks, such as controlling already performed commands and planning further work.

This is more in line with normal and hereditary habits in human behaviour.

The strain on the sensory organs is thus reduced relative to the present situation in which one of the sensory organs receives all information from the computer. The interpretation of information from touch/sensing takes

only approximately 2/3 of the time for interpreting visual impressions with the same amount of information.

Thus it is expected that the use of computers and software will become more effective. The experiences from trials and use of the system according to the invention is that it takes very short time before one is able to use it - and that those who have tried the system immediately sees great advantages for the ordinary user of computers.

The invention will be described below with reference to the accompanying drawings, illustrating the invention by way of examples on possible embodiments.

Figure 1 illustrates the movement of a marker over a computer screen with a number of defined areas.

Figure 2 shows a flow chart illustrating the use of a mouse according to the known art.

Figure 3 shows a flow chart of the system according to the invention.

Figure 4 illustrates the direction calculations for the marker over the screen.

Figure 5 illustrates a situation similar to figure 4, for a chosen zone..

Figure 6 shows an example of a drive unit for the tactile feedback connection on the mouse in horizontal and vertical sections.

Figure 7 shows a vertical section of the drive unit in figure 6, as well as a schematic image of the electromagnetic drives in a neutral condition.

Figure 8 shows a section and schematic image corresponding to figure 7, in which the drives are subject to a voltage in a first direction.

Figure 9 shows a similar situation as figure 8 in which the current is applied in the opposite direction.

Figure 10 illustrates the tactile surface of the mouse with the drive.

Figure 11 illustrates changes in the surface when voltages are applied.

Figure 12 shows a simplified sketch of changes in the surface.

Figure 13 shows a vertical section of ab active mouse.

Figure 14 shows a horizontal projection of the mouse in

figure 13.

Figure 1 shows a segment of an imagined image on a computer screen in which a number of squares indicate "points" which may be marked by the marker. The marker, which is shown as an arrow head, starts in the shown example with its tip in point A and is moved, lead or steered to point or target object B - a move that e.g. may follow the dotted line between these points. ~~The object of this movement may differ, depending on what level one is in the communication with the computer.~~

When the marker, however, has been moved to a chosen point a signal is sent to the computer stating that a receipt button (switch) on the pointer tool has been pushed.

As is evident from figure 1 it may easily happen, with unprecise control of the marker, that the marker ends up on one of the neighbouring points B1...B5, which may completely different meanings than when it is in point B, when the receipt is sent. The operator, who knows this, therefore concentrates when moving the marker so as to avoid mistakes - thus tensioning the muscles in his hand to increase the control. When a pointer device, e.g. a mouse, is moved over the supporting surface, control signals are sent from the mouse to a so-called mouse driver providing sequential images of the marker as if it moves following the same pattern over the data screen. The operator may thus control wether what he has done corresponds to the intensions - or if corrections are needed; see the description of figure 2 below.

In figure 1 a number of squares are shown. As mentioned above these are defined as points, which in practice means that it is not important where the tip of the marker is positioned within the square. The only thing of importance is wether the tip of the marker is inside or outside one of the squares.

Each of the points has a certain meaning in the present level the operator is in the communication with the computer:

* In the opening menu of the operating system each of the points may represent an addressable icon. By moving the marker to one of the icons and signing, one may

e.g. start a text editor, a spread sheet or any other program in the computer.

* In e.g. a text editor each of the points may symbolize letters in a word, as well as numbers or other symbols.

In figure 1 a "screen image" is shown in which a number of points (squares), each containing a command, possibly some form of information or opening a channel with information (from the keyboard or to the printer, to or from a mass storage such as CD, diskettes, etc); or where the points in another way has a meaning in the communication between the operator and the computer. Figure 1 also shows that areas without information may exist between the points.

Use of the communication button will not have any reasonable form for meaning for the computer without the markers point being within one of the points (one of the squares).

One the other hand use of the communication button while the markers point is positioned within one of the squares mean that the meaning being contained in this point is communicated to the computer for use in the program currently being used.

In the following the mouse provided according to the invention with tactile feedback will be called an "active mouse". The traditional type of mouse will hereafter be called a "passive mouse".

In the same way as a passive mouse, which needs a so-called mouse driver or a computer program translating (one way) information from the mouse to the computer, the active mouse also needs such a program.

The drive program for the active mouse has to be two way, as information is being transmitted both from the operator through the mouse and to the computer, as well as back from the computer to the operator.

As is shown in both figures 2 and 3 the operator 14 gives information through the mouse driver 16 to the computers operating system 11 by moving the mouse 15 with the hand. The mouse driver 16 generates, using a part of the screen driver 12, an image of an arrow or a marker which moves across the computer screen 13. If the mouse 15 is moved forward the marker moves upward on the screen; if the

mouse is moved e.g. to the left or the right, the marker moves to the left or the right, respectively. Using the controls on the mouse 15, and its position on the screen 13, the software 10 installed in the system is controlled. This is similar to both a "passive" and an "active" mouse.

An important part of the active mouse according to the invention is a corresponding computer program 17 (see figure 3). This computer program 17 has in this embodiment of the invention three tasks:

* The program calculates the most likely chosen movement of the marker 5, based on the first part of the trace of the movement of the marker.

** The program replaces then the marker 5, practically immediately, with a vector 6 which is shown from the starting point, which in this case was the point A in both figures 1 and 4; and which ends in the point closest to the most likely direction. The vector 6 has preferably a clearly visible contrast colour. The signal path being shown as a dotted line in figure 3.

*** at the same time as the visual vector 6 is shown on the computer screen signals are also sent to a motor drive 18 for a specialized, motor (see figures 6-9) for controlling a special, tactile part 19 of the mouse 15.

In figure 4 the markers movement started from point A, as in figure 1, and the chosen target is B. Depending on how precisely the pointer tool was controlled from the beginning the situation may be contemplated in which vector 6 may initially have a direction til any of the points p1...p12, while the shortest way to the target would have been in two steps from A to p9 and then from p9 to B, as shown in figure 5. Let us in this example presume that the first vector that was shown was from A to p4, which essentially corresponds to the direction toward p9. The operator is not happy with the direction and corrects it by shifting the pointer tool to the right. The correction is shown as the direction 7 of the vector sequentially shifts in the direction of p5; p6; p7; p8 and at last p9, which is the preferred direction. Here he is pleased and may signal this by pushing the communication button on the pointer

tool. The vector now changes into a marker until a new movement is started. Possibly a chosen, unique movement of the motor may indicate that the target is reached.

On the way to the partial target: p9, the specialized motor progressively changed its shape under the finger of the operator so that the direction and length of the vector at any time may be felt.

In some cases it will be preferable to let the vector on the screen be hidden, and for example maintain the usual marker, while the active mouse provides the direction and size of the vector. This is especially preferable if the image on the screen is well arranged, so that it is unambiguous from the mouse indications toward which point on the screen the marker is moving.

The abovementioned example is chosen to show how the movement of the vector may be steered toward the target, even if there are many active points on the computer screen.

If there is no "free line of sight" all the way from the starting point A to the target B the path must be divided as shown in figures 4 and 5 in a generalized case. If, however, information is available or experience shows that makes B in the example the most probable target, the program may learn this and automatically start with the vector A - B as the first alternative. Thus time may be saved.

The motor, as is shown in figure 6, may be built around a disc-shaped, permanent magnet 1. In figure 6 the magnet is shown in a horizontal position with (e.g.) the north pole directed upward and the south pole pointing downward. The magnetic fields are collected and lead toward the sides of ferromagnetic pole shoe (2N) on the upper send and (2S) on the lower end. From the two projections on figure 6 it is clear that the pole shoes (2) are made in a way that gives them a spherical shape on the part of the surface directed toward the sides. The magnet and the pole shoes being assembled in a unit using e.g. a suitable adhesive, is pivotally supported by a sphere 3 which in turn is fastened to a foundation 4. The permanent magnet unit consisting of 1, 2N and 2S is below called an anchor. This may swing freely relative to the pivot bearing within the limits

defined by the geometry of the foundation. At the sides of the movable anchor fastened pole shoes 50 are positioned which usually closes the magnetic field between the anchor pole shoes 2N,2S, see the side projection on top of figure 6. The pole shoes 50 are coupled to the field collector through a coil core 70, which all are made from ferromagnetic materials. Around the coil core 70 a coil 60 of insulated copper wire 600 is winded; see figure 7. If an electrical current is lead through the coil an electromagnetic field is generated around it.

At the bottom of figure 6 a horizontal section of the motor is shown. It is evident from this that it contains a total of four coils 61; 62; 63; 64, of which the coils 61 and 63 are coupled in a series - an likewise the coils 62 and 64; see also figure 7. The four coils are coupled to the pole shoes 51; 52; 53; 54 and field collectors 81; 82; 83; 84 through the respective coil cores 71; 72; 73; 74. The field collectors are ultimately coupled to each other through the magnet conductors 91; 92; 93; 94 so that the fields being generated by transmitting electrical current through the copper coils, also are closed.

As current is lead through the coil pair 62;64 the anchor will try to move in (+/-) X direction in figure 6. The current is lead through the coils 61;63 the anchor will seek to move in the (+/-) Y direction in figure 6.

In figure 7 the anchor with the permanent magnet as well as the fastened pole shoe with copper coils are shown in the upper part of the figure while the serial coupling of the 2+2 coils are shown at the bottom. No electrical current is lead through the coils in the shown position in figure 7.

In figure 8 and 9 it is the principle of how the magnetic fields generated by transmitting an electrical current will affect the position of the anchor. The anchor may thus be rotated in the two independent orthogonal directions X and Y of the two coil pairs. The extent of the rotation in each of the direction will by suitable design of the anchor and pole shoe, be proportionally increasing with increasing current through the coils. If an electrical current is lead through the coils a magnetic

field will be generated around each of the coils with north-south directions as shown at the left of figure 8 below. The magnetic fields will be collected by the fastened ferromagnetic coil cores and pole shoes so that the equalization of the magnetic field through the pole shoes on the rotatable anchor is disturbed. The anchor will immediately rotate til a new equilibrium position as shown at the right in figure 8. The angular deflection of the new equilibrium relative to the equilibrium without current through the coils, will be essentially proportionally increasing with increasing current. If the anchor is hindered from moving freely the anchor will react with a reaction force being proportionally increasing with the current strength. If the current direction is reversed, as illustrated in figure 9, the field direction will be reversed, and the anchor will try to move in the opposite direction.

The anchor will thus rotate relative to the centre of the spherical bearing 3, both in the (+/-) X and Y direction, i.e. in principle in all directions in the XY plane, and with indications being proportional to the current in the respective coil pairs. The magnitude of the indication may be chosen to indicate the distance from the marker to the target object or, in some cases, the velocity across the screen.

The object of the anchor in the motor unit is to translate the signals from the motor drive to a tactile indication to be interpreted by the finger tip resting on the motor unit so as to sense a representation of the vector in figures 4 and 5, both in size and direction, so that both speed and direction may be felt.

The anchor is, however, not necessarily ideal for filling this task alone, and the split opening between the pole shoes 2 of the anchor and the fastened pole shoes 51...54 must be protected against particles and dirt in order to secure an undisturbed operation.

Depending on which type of pointer tool is used the connection between the anchor and the contact surface, with corresponding dirt protection, may have require slightly different embodiments. Below, on figure 10, an embodiment

is shown being suitable for use together with a mouse being used as pointer tool. In order to avoid a collision between the protruding edge of the upper pole shoe of the anchor and the finger, a moveable part is provided between as a "contact surface" 111 in a suitable vertical distance from the anchor. The contact surface 111 may be shaped more ergometrically advantageous than what is possible with the anchor. The movements of the anchor is transmitted to the contact surface 111 through three transmission pins 110 of which two are shown in figure 10. Through the transmission pins it is made sure that the movement of the surface 111 follows the movements of the pole shoe 2 on the anchor. In figure 10 the geometry for the contact points between the surfaces 2 and 111 and the pins 110 shown as a rectangle (parallelogram), which provides a representation of the pattern of movements, essentially 1:1 between the two surfaces. If the geometry is changed so that the contact points make out a trapezoid, the movements of the contact surface is increased or decreased relative to the anchor movements, depending on the bearing distance being largest on the anchor or on the contact surface.

To the circumference of the two-axis motor a double curved plate or membrane of an elastic material 112, e.g. of silicone rubber or similar, is fastened. The contact surface 111 is also fastened to this elastic membrane so as not to be shifted relative to the membrane. Thus the contact surface 111 is kept essentially in place right above the anchor, even if it moves as a result of a current being sent through the coils, see figure 11, in which the effect a current direction (+) is shown on the right figure while a corresponding effect of the opposite current direction (-) is shown on the left.

In figure 12 the contours of the bi-axial motor is shown from one side. To the left in the figure the motor is shown with a neutral position. In the drawing in the middle the motor is shown with an indication generated by a current in one direction, and t to the right with an indication in the opposite direction.

The motor may give indications both in the X and the Y directions. In figure 12 it is by purpose not shown if it

is X or Y indications that are shown in the drawings as they would be identical in both cases.

The motor is positioned on the pointer tool under the most natural contact point for the operators fingers, and is constructed so as to shape the support in a way which in principle gives the operator the same information about the direction of the vectors direction and length as he simultaneously may see on the screen.

In figure 13 it is shown how the self developed "motor" M may be integrated into one of the buttons on a "standard" mouse. The mouse is thus in a simple way changed from being "passive" to "active". The motor follows the movements of the communication button, and the communication button B and the electronic card E is activated by pushing the motor down. The card E may simply be extended to comprise the necessary drive electronics for the motor M.

When an active mouse is produced one may therefore use existing components from the passive mouse with the exceptions of the electronic part E and the button, which must be rebuilt so that it contains the biaxial motor M.

The "active mouse" may be used exactly as a "passive mouse". The operators finger rests, as before, on the left communication button. If he wants to send a signal it is pushed the same way he is used to. The signal is transmitted through the motor. The contact point for the finger tip is, however, on the button in the same position as the contact surface 111. The operator will therefore already without training be able to feel a movement in the motor M corresponding to the extra image the system generates on the screen.

In figure 13 a normal resting position is drawn as contour a). If the image showing the markers most likely new position implies that it moves "upward" on the screen, the motor moves corresponding to contour b). Correspondingly the movement "downward" is shown with the motors movement corresponding to contour c).

In figure 14 the "active mouse" is shown from above. On the bi-axial motor on the figure integrated in the left mouse button the axial directions X and Y are indicated.

Even if the description above refers to an active mouse

with a possibility for indicating movements in two dimensions it is also possible to extend this to a third dimension, by providing the tactile part with an ability to move vertically. This may be used to indicate surface structures on the screen, as well as indicate the borders of the different areas on the screen, so that the user may feel when he for example enters a new window. This will technically be achieved when all the coils 61; 62; 63; 64 in figure 6 are adapted to provide the same polarity relative to the permanent magnet 1, so that it is lifted or lowered. The embodiment of the bearing 3;4 and the pole shoes 51; 52; 53; 54 must be altered in a way obvious in the art.

C l a i m s

1. System for controlling a marker (5) on a computer screen or similar using a pointer tool (8) of a per se known type, the pointer tool comprising an indication device (1,2,110,111,112) for tactile feedback to the user for transmitting information about the marks movements on the screen,
c h a r a c t e r in z e d in that the indication device (1,2,110,111,112) for tactile feedback is adapted to transmit tactile information in at least two dimensions.

2. System according to claim 1,
c h a r a c t e r in z e d in that the indication device for tactile feedback (1,2,110,111,112) comprises a movable part (110,111) related to the pointer tool, said movable part being adapted to move in at least two dimensions.

3. System according to claim 1 or 2,
c h a r a c t e r in z e d in that the system comprises calculation means for calculating the direction of the marker (5) on the screen and recognition of a presumed target (B) in the calculated direction, and that the indication device for tactile feedback is adapted to indicate, by moving a movable part (111), the direction to the target (B) on the screen.

4. System according to claim 3,
c h a r a c t e r in z e d in that a vector for the calculated direction and the presumed target (B) is indicated on the computer screen.

5. System according to claim 3 or 4,
c h a r a c t e r in z e d in that the system comprises estimating means for estimating the target (B) for the markers movements, and that the magnitude of the movement of said moving part (111) is graded in relation to the distance from the marker (5) to the target (B).

6. System according to any one of the preceding claims,

c h a r a c t e r in z e d in that said moving part (111) is adapted to move in a third dimension, said third dimension being adapted to indicate the possible presence of structures and object in the screen image on the computer screen.

7. System according to any one of the preceding claims, c h a r a c t e r in z e d in that the indication device comprises a rotatably supported permanent magnet (1,2) adapted to rotate in two directions relative to a support point (3) and being related to an indication device (111), and two or more electromagnetic devices (50,70,80) for applying a magnetic field to the permanent magnet (1,2) in at least two directions, thus to generate a rotation of the indication device relative to said support point,

said electromagnetic devices (50,70,80) being coupled to calculation devices adapted to estimate the markers movements on the computer screen and recognizing a presumed target (B) on the computer screen, and for controlling the applied magnetic fields as a function of the direction to the target (B).

8. System according to claim 7, c h a r a c t e r in z e d in that the strength of the applied magnetic field is proportional to the distance between the marker and the target (B) of the movement.

9. System according to any one of the preceding claims, c h a r a c t e r in z e d in that the indication device comprises a flexible membrane (112) related to the moveable part (111) for protecting the moveable parts of the device.

AMENDED CLAIMS

[received by the International Bureau on 24 November 1999 (24.11.99); original claims 1-9 replaced by amended claims 1-8 (2 pages)]

1. System for controlling a marker (5) on a computer screen or similar using a pointer tool (8) of a per se known type, the pointer tool comprising an indication device (1,2,110,111,112) for tactile feedback to the user for transmitting information about the marks movements on the screen, the indication device (1,2,110,111,112) for tactile feedback being adapted to transmit tactile information in at least two dimensions,
c h a r a c t e r i z e d in that the indication device for tactile feedback (1,2,110,111,112) comprises a movable part (110,111) related to the pointer tool, said movable part being adapted to move in at least two dimensions.

2. System according to claim 1,
c h a r a c t e r i z e d in that the system comprises calculation means for calculating the direction of the marker (5) on the screen and recognition of a presumed target (B) in the calculated direction, and that the indication device for tactile feedback is adapted to indicate, by moving a movable part (111), the direction to the target (B) on the screen.

3. System according to claim 2,
c h a r a c t e r i z e d in that a vector for the calculated direction and the presumed target (B) is indicated on the computer screen.

4. System according to claim 2 or 3,
c h a r a c t e r i z e d in that the system comprises estimating means for estimating the target (B) for the markers movements, and that the magnitude of the movement of said moving part (111) is graded in relation to the distance from the marker (5) to the target (B).

5. System according to any one of the preceding claims, c h a r a c t e r i z e d in that said moving part (111) is adapted to move in a third dimension, said third dimension being adapted to indicate the possible presence of structures and object in the screen image on the computer screen.

6. System according to any one of the preceding claims, c h a r a c t e r i z e d in that the indication device comprises a rotatably supported permanent magnet (1,2) adapted to rotate in two directions relative to a support point (3) and being related to an indication device (111), and two or more electromagnetic devices (50,70,80) for applying a magnetic field to the permanent magnet (1,2) in at least two directions, thus to generate a rotation of the indication device relative to said support point,

said electromagnetic devices (50,70,80) being coupled to calculation devices adapted to estimate the markers movements on the computer screen and recognizing a presumed target (B) on the computer screen, and for controlling the applied magnetic fields as a function of the direction to the target (B).

7. System according to claim 6, c h a r a c t e r i z e d in that the strength of the applied magnetic field is proportional to the distance between the marker and the target (B) of the movement.

8. System according to any one of the preceding claims, c h a r a c t e r i z e d in that the indication device comprises a flexible membrane (112) related to the moveable part (111) for protecting the moveable parts of the device.

STATEMENT UNDER ARTICLE 19(1)

In the enclosed amended claims 1-8 claim 2 is incorporated in claim 1, and the original claim 1 constitutes the preamble of the new claim 1.

This is done to because the cited documents all describes means for tactile feedback being adapted to transmit tactile information in at least two dimensions.

As is clear from the search report none of the cited documents describes a system comprising a movable member for transmitting the tactile feedback, as is now stated in the new characterizing part of claim 1. This special solution allows for a more flexible feedback indicating both the direction and magnitude of a movement on the screen, as well as a possibility for indicating the surface structures on the screen.

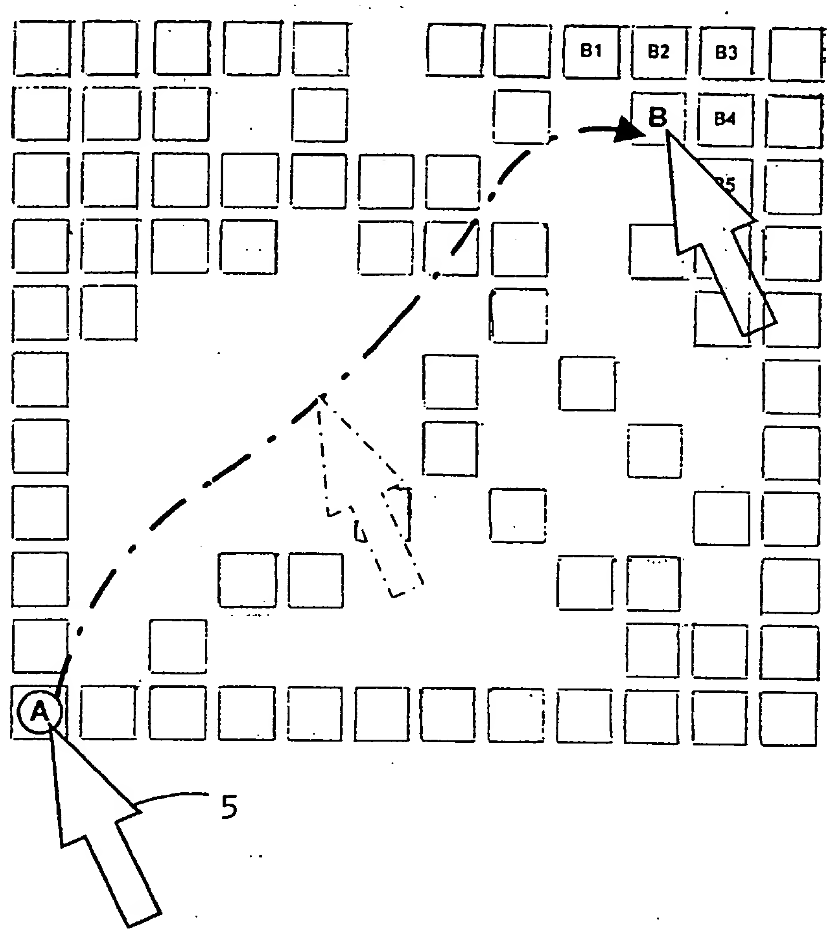


Fig. 1

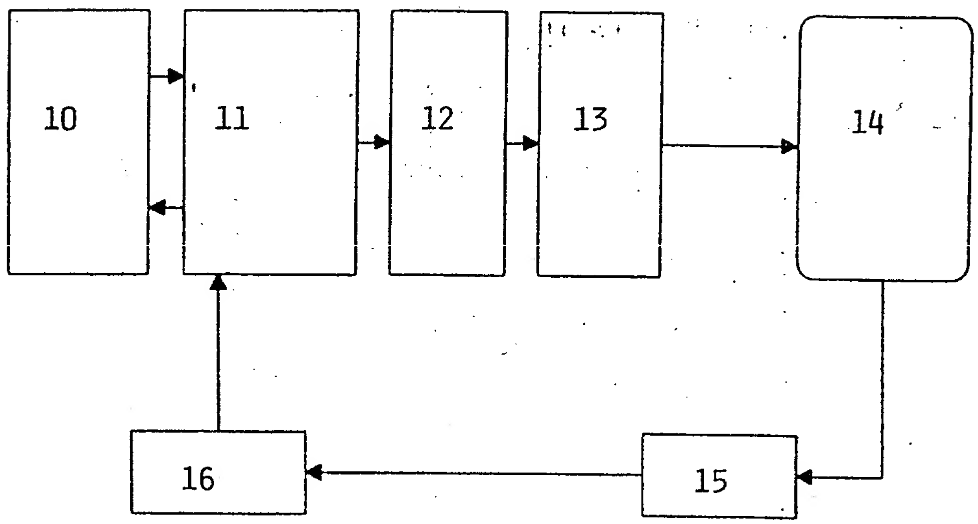


Fig. 2

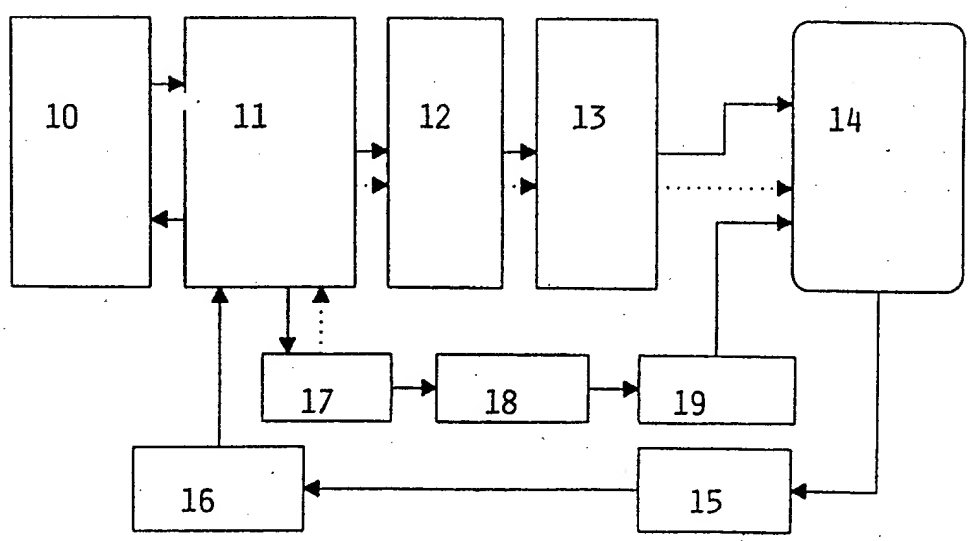
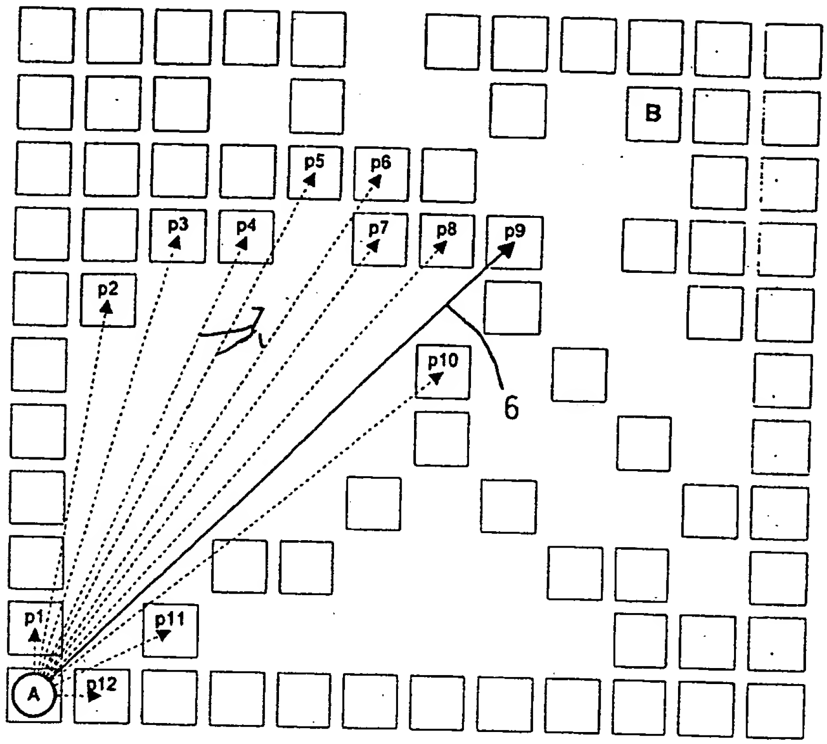


Fig. 3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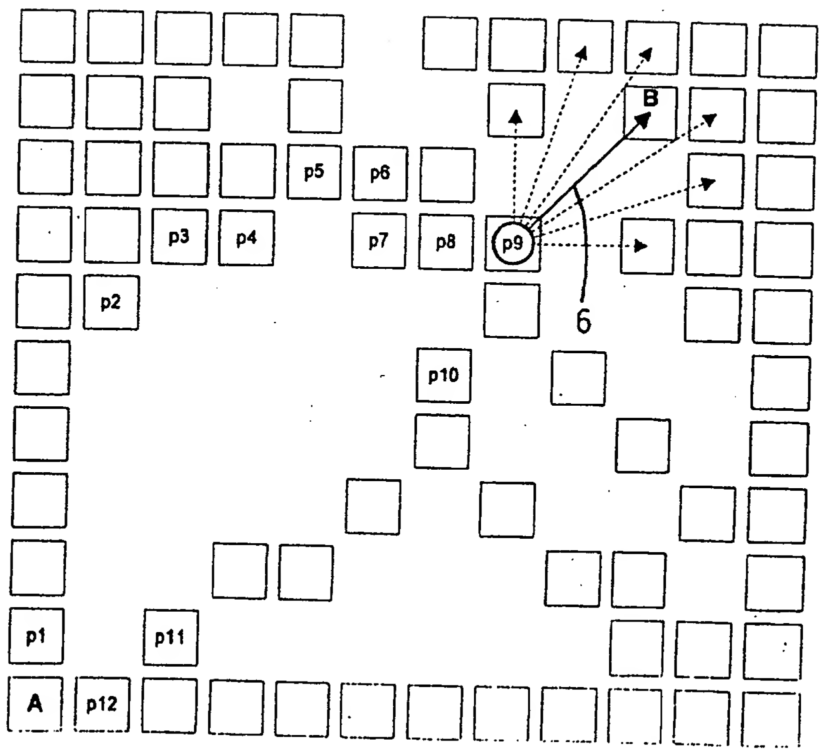
p3
p4
p7
p8
p9
p2
p10
6
p1
p11
A
p12

Fig. 4


B
p5
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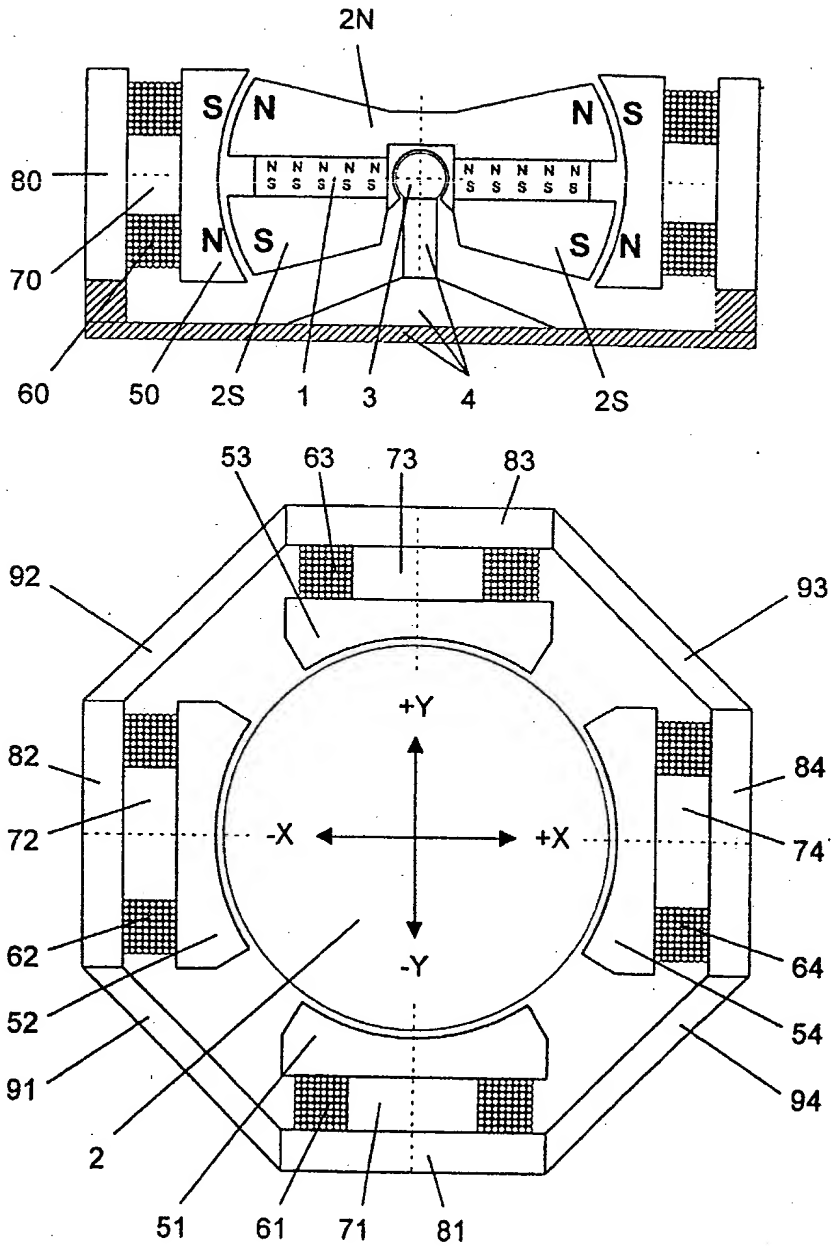
p4
p7
p8
p9
6
p2
p10
p1
p11
A
p12

Fig. 5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S
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N
S
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S S S S S
N N N N N
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N
S
S
N
80
70
60
50
2S
1
3
4
2S
53
63
73
83
92
93
+Y
82
84
72
-X
+X
74
62
-Y
64
52
54
91
94
2
51
61
71
81

Fig. 6

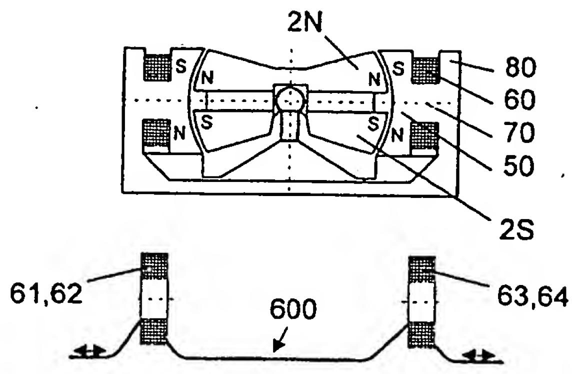

Fig. 7

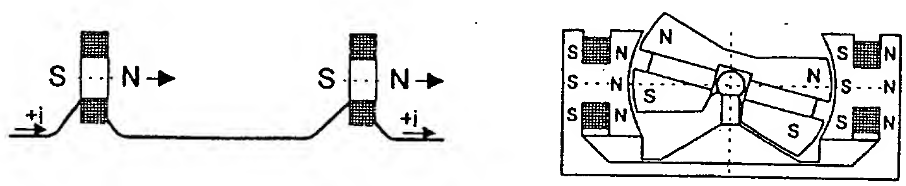

Fig. 8

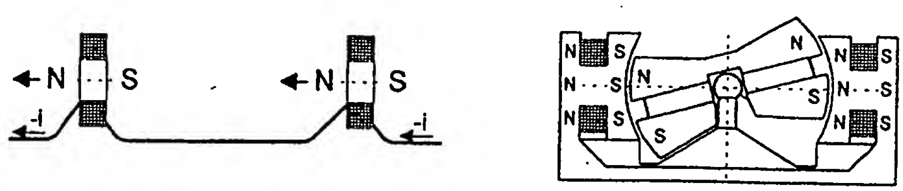

Fig. 9

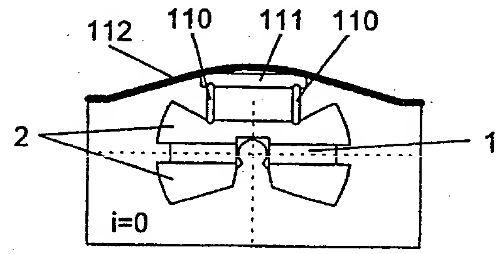

Fig. 10

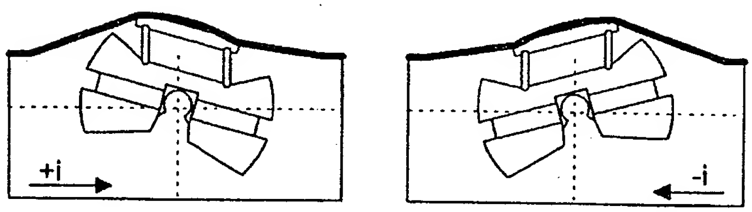

Fig. 11

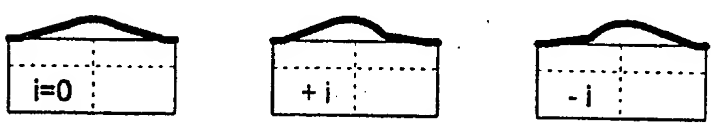

Fig. 12

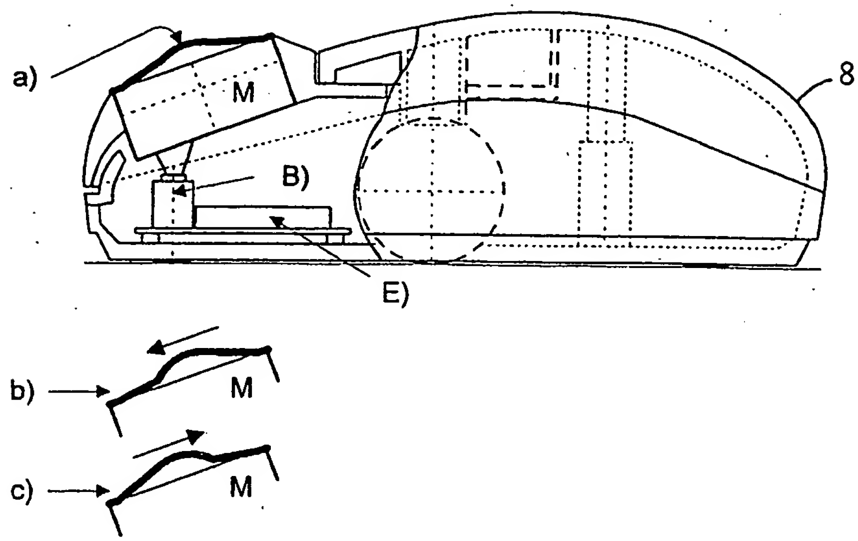

Fig. 13

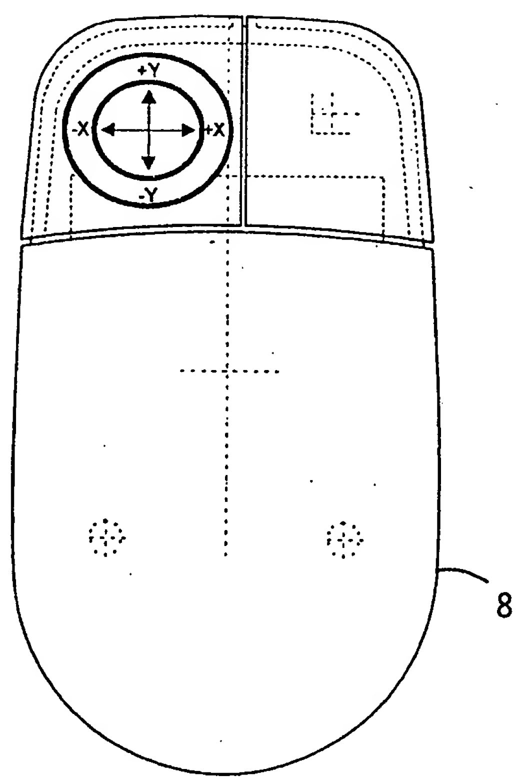

Fig. 14

INTERNATIONAL SEARCH REPORT

International application No.
PCT/NO 99/00207

A. CLASSIFICATION OF SUBJECT MATTER

IPC6: G06F 3/033, G06K 11/18
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC6: G06F, G06K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPODOC,WPI,NPL, FULLTEXT

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 4140780 A1 (GÖBEL, MATTHIAS), 10 Sept 1992 (10.09.92), figures 1-3, abstract	1
A		3-5
	--	
X	DE 4319795 A1 (GüLKER, JOCHEN), 13 January 1994 (13.01.94), claims 1,3	1
A		3-8
	--	
X	US 5912660 A (ROMAN GOUZMAN ET AL), 15 June 1999 (15.06.99), figures 1B, 3A,B, abstract	1
A		3-5
	--	

☐ Further documents are listed in the continuation of Box C.　☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
21 October 1999	30 -10- 1999
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Katarina Ekman/MP Telephone No. + 46 8 782 25 00

INTERNATIONAL SEARCH REPORT
Information on patent family members

28/09/99

International application No.
PCT/NO 99/00207

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 4140780 A1	10/09/92	NONE	
DE 4319795 A1	13/01/94	NONE	
US 5912660 A	15/06/99	AU 7995498 A WO 9831005 A	03/08/98 16/07/98

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